2.3.4. Tracking Rate Limits

2.3.4.1. Purpose

The purpose of this test is to determine the tracking rate limits for radars able to establish an STT and to determine their effects upon intercept and attack utility.

2.3.4.2. General

When an operator establishes an STT for the purposes of executing an intercept and maneuvering to an attack position it can be assumed that the target will attempt to maneuver out of the attack envelope quite vigorously. For this reason, the ability of the radar to track a target with various maneuver rates is important. The limit can be caused by a number of factors, including the angular rate with which the antenna can slew, for radars where the antenna beam is centered on the STT by pointing the antenna; the size of the tracking gate and update rate, which define the theoretical probability of achieving detection and updating the track parameters during a given maneuver; and even by the general quality of the tracking system, since a poor tracker certainly does not get better when the target maneuvers.

2.3.4.3. Instrumentation

Data cards and a stop watch are required for the test with an optional voice recorder.

2.3.4.4. Data Required

Note the time for the target to go from 45° at one side of the test airplane nose as displayed on the radar to 45° on the other side of the test airplane nose for each g level tested. Note if tracking is lost at any g level. Record qualitative comments concerning the effects of the tracking rate limits (if any are found) during mission relatable maneuvers while positioning for an attack.

2.3.4.5. Procedure

Place the target at 50° to one side of the nose at 1/2 nm with the target at the same heading and speed as the test airplane. Establish an STT. Roll the test airplane briskly but smoothly to obtain a 2g level turn toward the target, noting the g level, time from the point where the target passes through 45° on the same side of the nose to reaching 45° on the other side of the nose and note if tracking is lost during the turn. If the maximum scan angle limit is less than 50° off of the nose, smaller angles will have to be used. Repeat in 1 or 2 g increments, building up to the maximum g limit of the airplane. Next, repeat the test with the test airplane turning at the maximum g limit while the target turns in the opposite direction starting at 2 g and then at 1 or 2 g level increments to the maximum g limits of both airplanes. During mission relatable attack maneuvers, note any limitations to tactics caused by the tracking rate limits.

2.3.4.6. Data Analysis and Presentation

The average tracking rate at lost tracking can be found approximately by dividing the measured time into the number of degrees the target passes through (90° if the scan angle limits allow). The validity of the rate depends upon how precisely the g is held since transients above the g desired may leave the average tracking rate low while tracking rate transients might be high enough to break the track. Making a brisk roll to the correct angle of bank and beginning the time measurement after the g is captured prevents the initial build up in g from driving the average tracking rate too low. It is important to keep the upper g excursions as low as possible. When both aircraft are maneuvering, the start of the turns must be carefully coordinated.

If tracking is lost during the roll itself, before a tracking rate is established, the problem is most likely an antenna stabilization limit in the roll axis. A test for this parameter will be presented later. The tracking rate limit will be undefined but will probably be satisfactory if tracking is achieved within the g limits of both airplanes. If tracking is successfully broken during the test, the limit should be related to the restrictions this upper limit places on tactics. For example, the pilot may have to rely on a visual attack for violently maneuvering targets without the aid of radar derived information. More importantly, without radar illumination of the target, some weapons become unusable.

2.3.4.7. Data Cards

A sample data card is provided as card 8.

CARD NUMBER ___ TIME PRIORITY L/M/H

TRACKING RATE LIMITS

[JOIN THE TARGET 1/2 NM IN TRAIL WITH THE TARGET 50° TO ONE SIDE OF THE NOSE. PLACE THE TARGET AT THE SAME HEADING AND 1,000 FEET ABOVE THE TEST AIRPLANE. ESTABLISH STT. ROLL TO INTERCEPT A 2 G, LEVEL TURN. REPEAT AT AN INCREASING G. NOTE THE G AND TIME FOR THE TARGET TO GO FROM 45° ON ONE SIDE OF THE NOSE TO THE OTHER. REPEAT WITH THE TARGET MAKING A 2 G TURN IN THE OPPOSITE DIRECTION, AND AGAIN REPEAT AT INCREASING G.]

G TEST /TARGET AIRCRAFT	TIME	BROKEN Y/N	G TEST /TARGET AIRCRAFT	TIME	BROKEN Y/N

[TRACKING RATE LIMITS QUALITATIVE COMMENTS DURING ACM.]

TYPE OF MANEUVER _____

EFFECTS:

Card 8: Tracking Rate Limits Data Card